RELATION BETWEEN PUFFS INDUCED IN SALIVARY-GLAND CHROMOSOMES OF THE *DROSOPHILA MELANOGASTER* AND HEAT PRODUCED BY MICROWAVE IRRADIATION[1)]

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In 1994, Yujiro Kamiguchi *et al.* of the Department of Biological Sciences, Asahikawa Medical College, conducted a study called "Effects of Microwave Irradiation on Human Sperm Chromosomes". In this test human sperms was irradiated with microwaves frequency, (2.45 GHz; output, 500 W) for 5 seconds and for 10 seconds. The study revealed that, as far as the survival rate is concerned, the microwave of 2.45 GHz and 500 W for 10 seconds is the maximum, since only a few sperm survived the test (Table 1, Kamiguchi in 1994).

This result is similar to the finding of an experiment the present author conducted in 1992 in which the number of adult flies emerged began to decrease with exposure to an output of 500 W for 10 seconds (Fig. 1). Kamiguchi performed an interspecific *in-vitro* fertilization using the surviving sperm with zona-free hamster oocytes in order to study sperms chromosome aberrations. He reported that no particular aberrations of human sperm chromosomes were noted in comparison with those of the control group (Table 2, Kamiguchi *et al.*)

The prerent author conducted a research project in 1994 along with Kamiguchi's study to investigate the heat effects of microwaves using a household microwave oven with a frequency of 2.45 GHz and in output of 500 W for 5 seconds and for 10 seconds on late third-instar larvae.

(1) In 1962, Ritossa bred in an incubator for 40 minutes at 37 degrees C, late third-instar larvae that had previously been bred in a normal incubator at 25 degrees C. Further Ashburner (1970c) found 9 different types of temperature shock induced puffs on the arms (2L, 2R, 3L, and 3R) of larva irradiated with microwaves (Fig. 2). The present author peformed a study using the same method by placing late third-instar larvae in the styrofoam box she had previously been using.

(2) In the same manner as Kamiguchi *et al.* used we placed late third-instar larvlae in a styrofoam box to in order to examine the puffs

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induced by irradiating larvae with microwaves of 500 W for 5 seconds and for 10 seconds.

(3) T the present anthor puts late third-instar larvae in a glass bottle which was then placed in a hot bath kept at 37 degrees C; she then left them for 40 minutes with no feed given.

In the above three experiments, we observed the formation of puffs on salivary-gland chromosomes.

(1) Unfortunately, no puff formations as definite as those Ashburner found were observed (Fig. 3). (2) In the 500 W, 10-second irradiation test, definite induced puffs were found at 3L, 63Bc, 64F and 67B locations on the arm of the salivary-gland chromosomes. This completely agrees with same of the result of the study by Ashburner (1970c) (Fig. 4). The result of (3) above was the same as the structure of the untreated salivary-gland chromosome structure (Fig. 5) Fig. 6 show the control group. The difference of puff formation between (1), (2) and (3) may be attributable to the difference in heating methods.

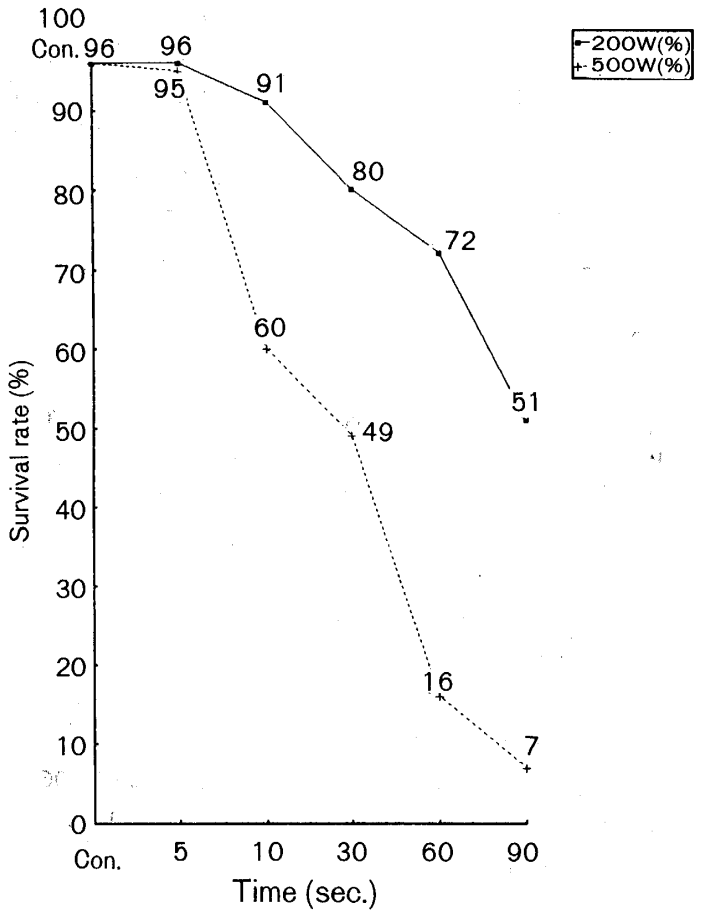

Fig. 1. Relationship between the rate of survival and the duration of microwave irradiation (Date of Tonomura *et al.*, 1992).

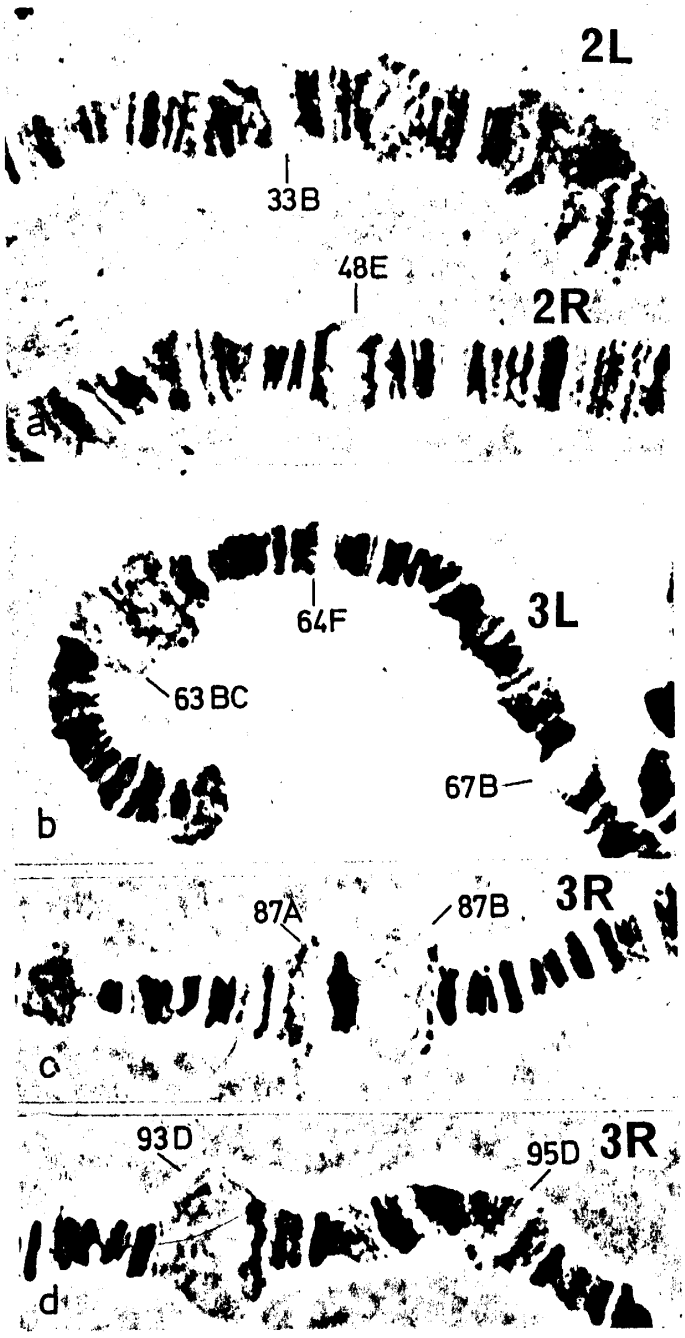

Fig. 2. Temperature shock induced puffs in *D. melanogaster,* as result of 40 mins at 37℃. a. 2L and 2R with 33B and 48E, b 3L with 63BC, 64F and 67B, c and d 3R with 87A, 87B, 93D and 95D. (Ashburner, 1972).

Since our previous study (Tonomura *et al.,* 1990) with 200 W and 60-second irradiation of late third-inster larvae had revealed the induction of 9 types of puffs induced as reported by Ashburner in 1972 (Fig. 7), Kamiguchi investigated the mechanism of a household microwave oven in a preliminary experiment before his main study. He found that, with

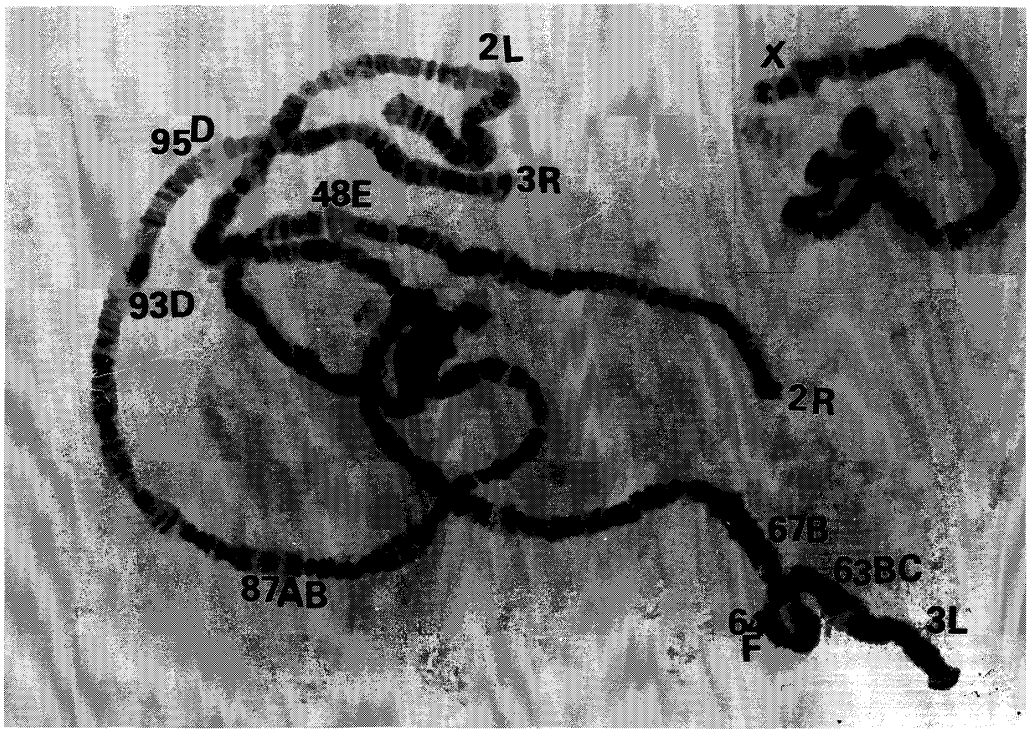

Fig. 3. Photomicrograph of the salivary chromosome of *D. melanogaster* which were subjected to the same test by Ritossa's method, a few puff formation as definite as those Ashburner (1972). 2R with 48E, 3L with 63BC, 64F, 67B and 3R with 93D, 95D.

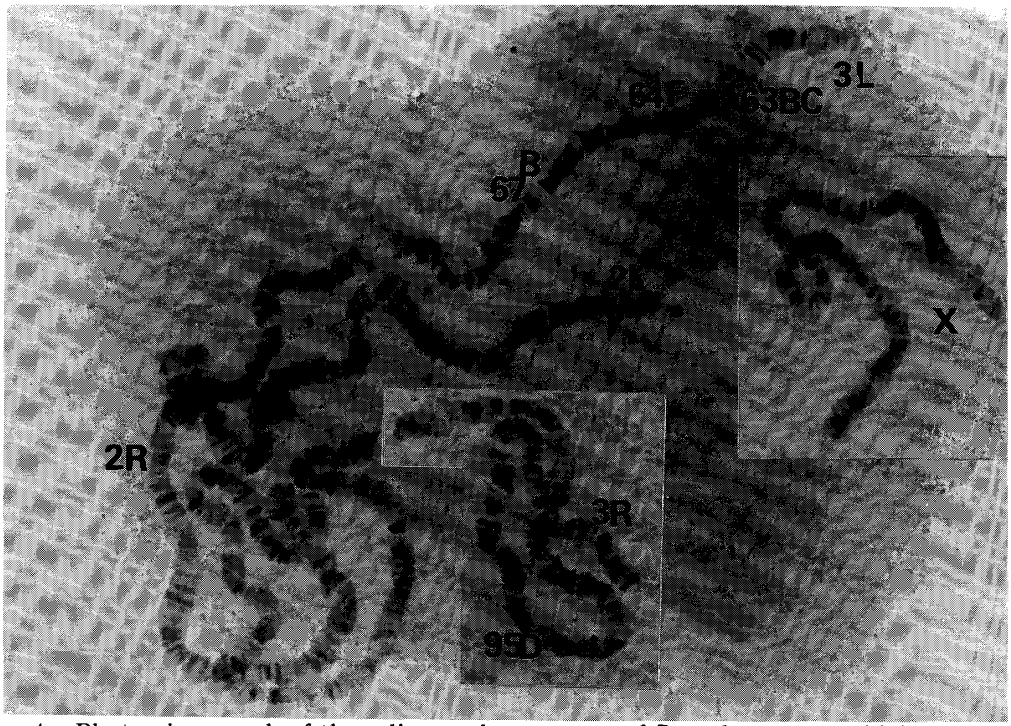

Fig. 4. Photomicrograph of the salivary chromosome of *D. melanogaster* which were subjected to irradiation test when they were late third-instar larvae using microwaves with output powers of 500 W, 10-second, 3L with 63BC, 64F and 67B, 3R with 95D (?).

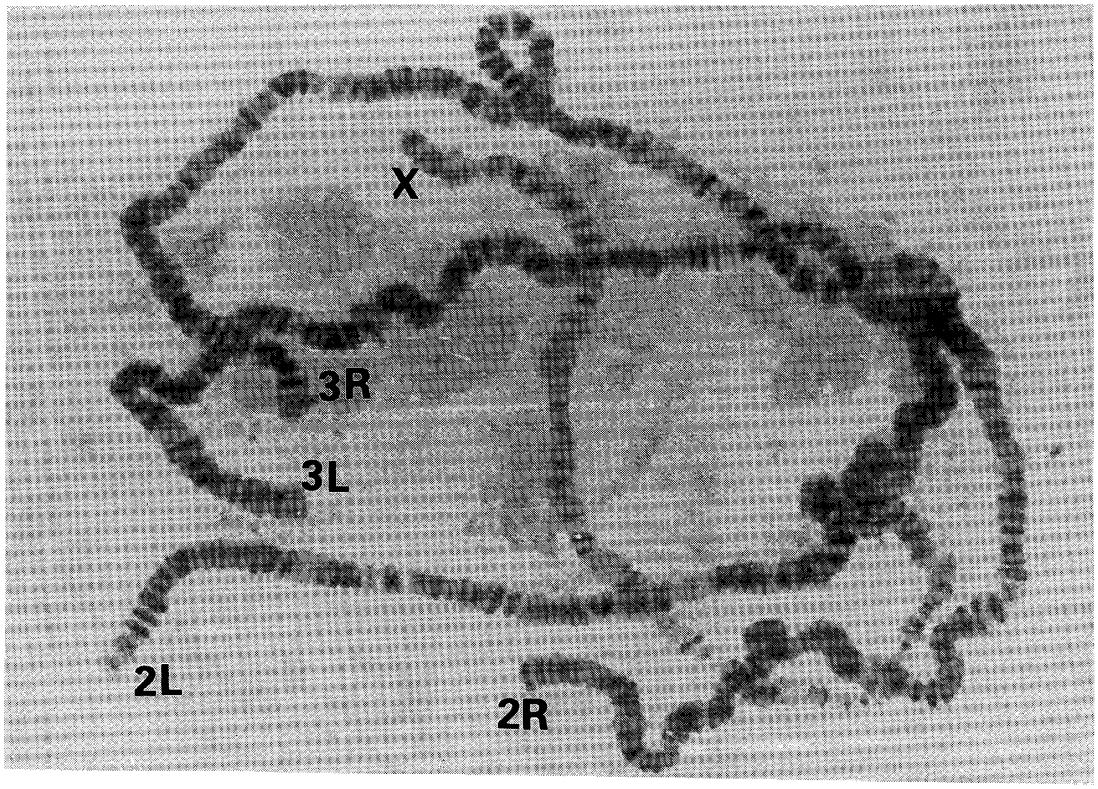

Fig. 5. Photomicrograph of the salivary chromosome of late third-instar larvae which placed in a hot bath (40 mins at 37℃). No puff formation as definite as those Ashburner.

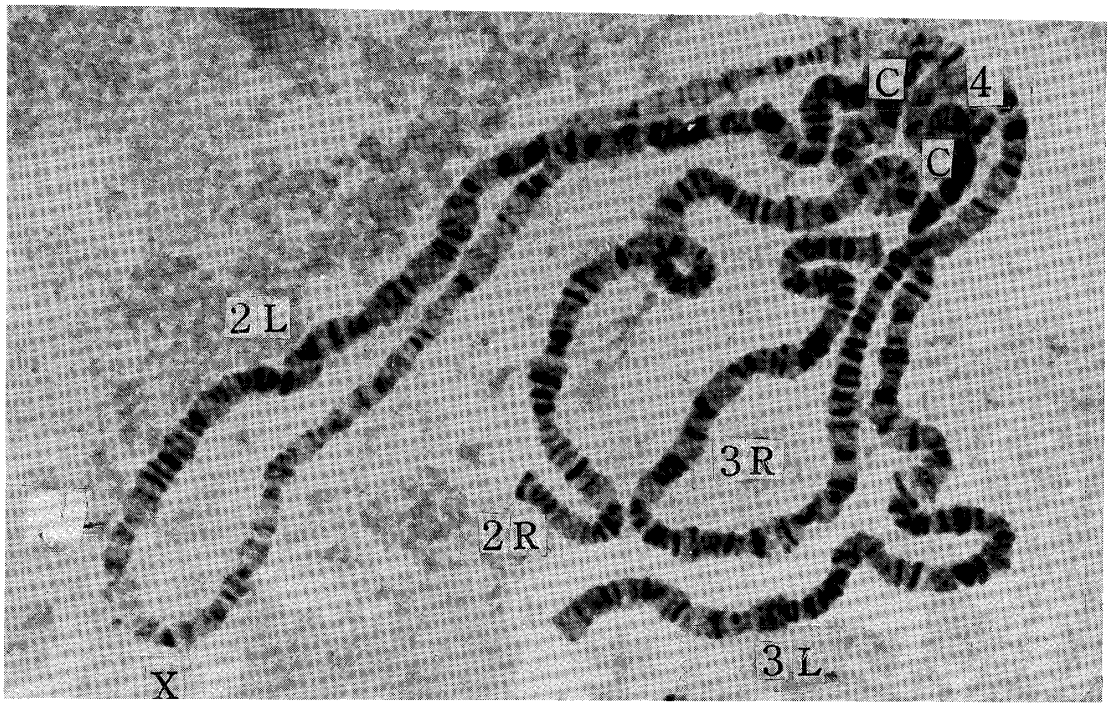

Fig. 6. Photomicrograph of the salivary chromosome of *D. melangaster* (control).

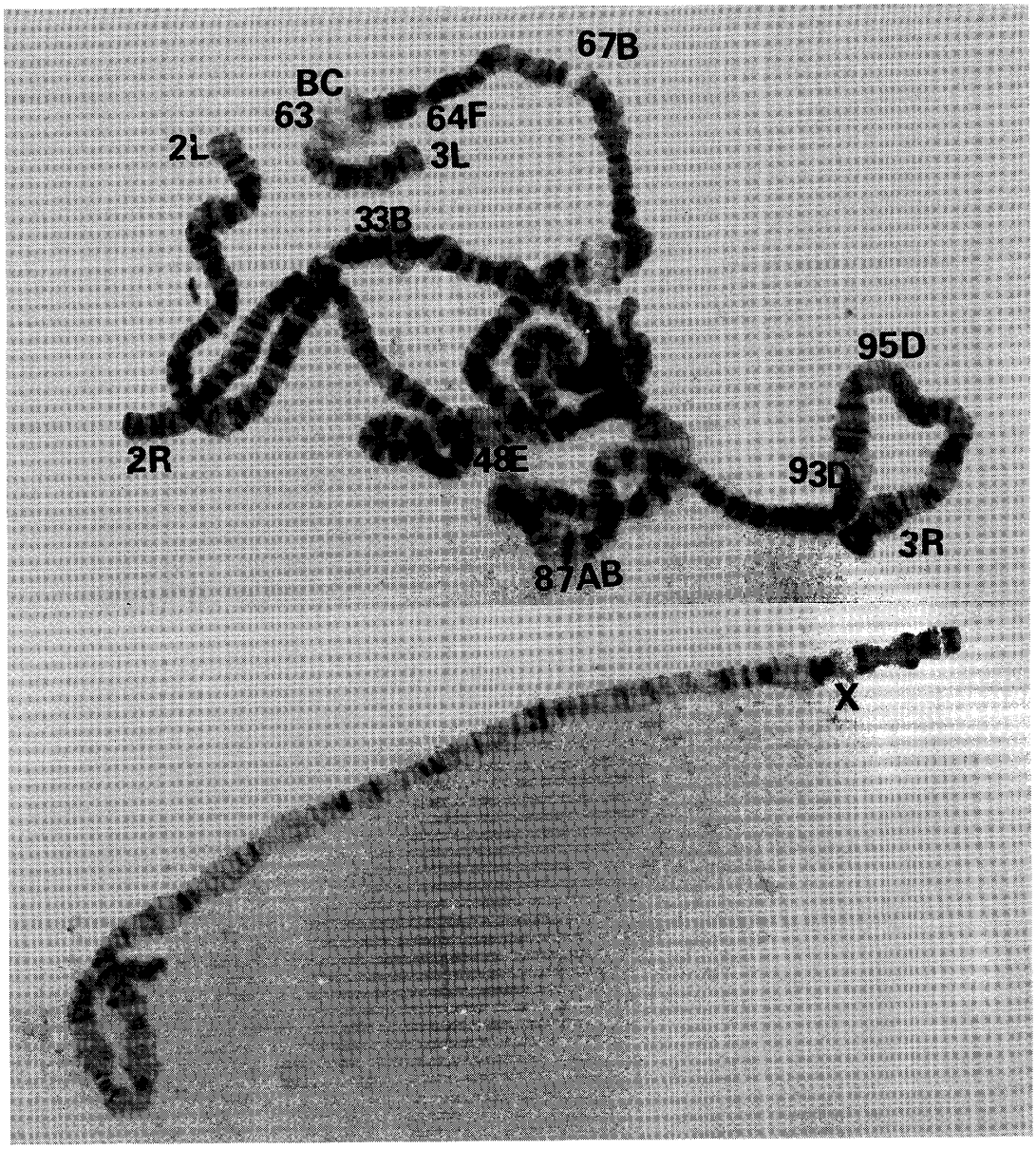

Fig. 7. Photomicrograph of the salivary chromosome 60 seconed exposure to microwave (200 W), (Tonomura *et al.*, 1990) 9 different types have been induced as reported by Ashburner (1972), 2L with 33B, 2R with 48E, 3L with 63BC, 64F and 67 B, 3R with 87A, 87B, 93D and 95D.

an output power of 200 W, the high-frequency radiation is not continuous. In other words, a 200 W microwave oven repeats a 30-second cycle: it produces microwave for 12 seconds and then stops radiation for the next 18 seconds. Because this renders a 200 W microwave oven unfit for the study, he only used a 500 W microwave oven, which produces microwaves continuously.

The heat effects of our 1990 study are considered to be the same as

temperature shock effects Ashburner obtained in their microwaves (200 W for 60 seconds) irradiation test. The present anthor assumes that the results of her current experiments (2) agree with Ashburner's finding that the puffs on salivary-gland chromosomes decrease upon exposure at 37 degrees C for one hour. In order to verify the above findings—that is, to learn the characteristics of microwaves, the present author must reexamine, in her research of 1995 the non-disjunction of chromosomes in oocytes by irradiating mutant flies with microwaves.

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